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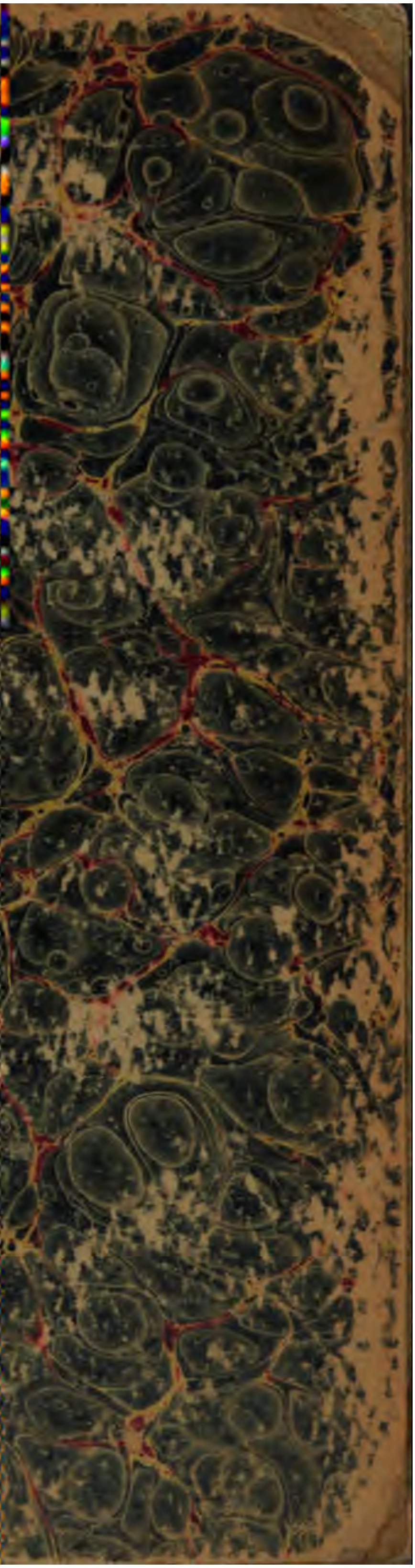

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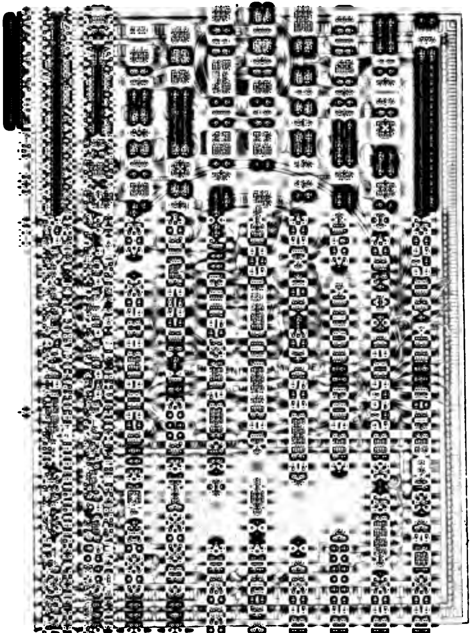

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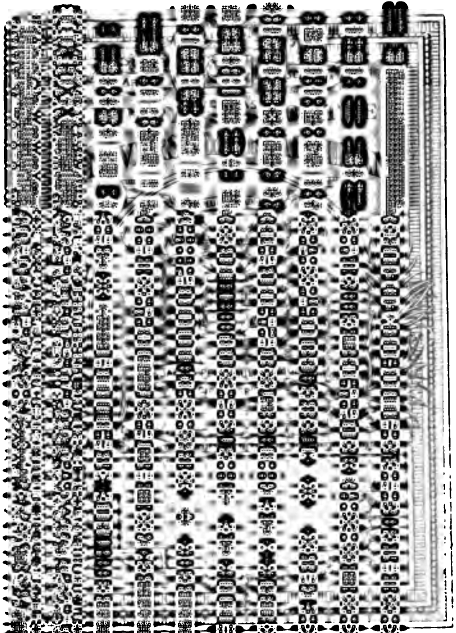

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THE

FAUNA OF SCOTLAND;

WITH SPECIAL REFERENCE TO

CLYDESDALE

AND THE

WESTERN DISTRICT.

FRESH AND BRACKISH-WATER OSTRACODA.

BY

DAVID ROBERTSON, F.L.S., F.G.S.,
MEMBER OF THE ZOOLOGICAL-BOTANICAL SOCIETY OF VIENNA.

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THE FAUNA OF SCOTLAND;

WITH SPECIAL REFERENCE TO CLYDESDALE AND THE WESTERN DISTRICT.

The Natural History Society of Glasgow, having resolved to publish Catalogues of the Fauna of Scotland, with special reference to Clydesdale and the Western District, requests the co-operation of all interested in Scottish Zoology. The following zoologists have agreed to draw up lists of the species in the various groups to which their names are appended. Any observers who can furnish information regarding the distribution of species, the variations which they undergo in particular localities, the altitudes which they reach, and generally any notes bearing on the subject, will further the object in view by communicating with these gentlemen, the lists being now in preparation.

The Council will also be glad to hear from any zoologists (whether members of the Society or not) who would undertake to prepare Catalogues of those classes for which no compilers have as yet been obtained.

As far as possible, the Catalogues will be drawn up on one *uniform* plan, and of the same size as the *Proceedings* of the Society, with which they will be issued to the members, although paged apart for future collection. A limited number of copies will also be printed for separate sale.

Rhizopoda,	David Robertson, F.L.S., F.G.S. (42 Kelvingrove Street, Glasgow.)
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Echinoidea,	Do.
Stellerida,	Do.
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THE FAUNA OF SCOTLAND,

WITH SPECIAL REFERENCE TO CLYDESDALE AND THE WESTERN DISTRICT.

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FRESH AND BRACKISH-WATER OSTRACODA.

INTRODUCTION.

In undertaking the preparation of a Catalogue of the Fresh and Brackish-water Ostracoda, chiefly of the West of Scotland, I have had great misgivings whether at the present time it could be brought to a satisfactory issue. I have to express my thanks to Dr. G. S. Brady for his valuable assistance in all cases of doubtful species. I may mention that the new species in this Catalogue will be described and figured in a joint Paper by Dr. G. S. Brady and myself.

To approach exhaustiveness, even in the most distant way, the various localities would not only have to be visited once, but several times in the year, as different species appear at different seasons. My opportunities have not allowed me to visit as many localities, nor these so frequently, as I could have wished, in the West of Scotland, and still fewer in the East; the list can therefore only be regarded as a record chiefly of characteristic species of the localities which have come under my observation.

The Fresh and Brackish-water Ostracoda, it is to be remembered, form but a small section of the Entomostraca, and the species will necessarily be fewer when confined to a limited area. The catalogue was at first intended to comprise gatherings only from the West of Scotland, but, on further consideration, it was thought advisable not to limit the boundary strictly to any one part of the country, as the more widely apart they are, the better will the districts show the various aspects of distribution.

One point in regard to distribution may be noticed, viz., there appears to be a greater dissimilarity of species between the east and west coasts of Scotland than between England and Scotland. In the neighbourhood of Edinburgh *Cypris gibba* is plentiful, sometimes gregarious almost to the exclusion of all others, whereas, on the west coast, it has been my experience to find that species but sparingly distributed.

Goniocypris mitra and *Cypris punctillata* are common to the east of Scotland and the fen districts of England, but are not yet recorded in the West of Scotland. Still, it is true that, on a comparison of localities one with another, so far as the results have been brought out, there is less difference existing between stations widely apart than might have been expected. The means of distribution do not seem to depend so much on the facilities of transport as on the conditions of locality. Ostracoda may be abundant in ditches and absent in the lochs and tarns that receive their waters. Examples of this are so common that they must be familiar to every one who has paid any attention to the subject.

The Ostracoda in this list, which may be considered to belong exclusively to brackish water, but never by choice to be purely marine, are *Cypris salina*, *Cypridopsis aculeata*, *Cytheridea torosa*, and its variety *teres*. The latter species and variety, although more estuarine, may be placed in the same category. *Cypris incongruens* and *Cypridopsis obesa* are frequently found in brackish water, but as frequently in purely fresh water. Many other species are occasionally met with in water more or less brackish, as in ponds a little above high-water mark, subject to the spray of the sea during high tides and storms, but chiefly in fresh water quite beyond the reach of marine influences. A group of small ponds lying close together along the south-west shore of the island of Cumbrae, and apparently subject to an equal amount of spray, may here be referred to. These ponds are mostly within a few yards of each other, and seem to be exposed to similar conditions, yet their microscopic fauna are found, when compared, to differ widely. A list of Ostracoda found in ten of these sub-brackish patches of water will best show the great number of reputed fresh-water species associated with those which constantly affect brackish water, and also the diversity in the numbers and grouping of species existing between one pond and another. This mixture of fresh and brackish-water species is all the more remarkable, as none of these ponds communicate with the others, nor with any fresh-water stream. All of them, as stated, are within a short distance of each other, only a little above high-water mark, and subject to the spray of the sea. The effect of this spray in transporting saline matter is well known, to the discomfort of the inhabitants of the cottages along the shore, the salt obscuring their windows after every storm.

All the gatherings were purposely taken for comparison on the same day, 15th October, 1878, so that they should all be alike so far as regards weather conditions and season of the year. Seeing that the same species are often found widely apart, there can be no doubt that there are ample means of transport to distant localities afforded to these minute organisms—much more, we should think, to those of closer proximity. It appears that some other condition than the saline element is necessary for the presence of one of our most characteristic brackish-water species—viz., *Cypridopsis aculeata*—as only in three of these ponds do we find it. *Cypris salina*, another characteristic brackish-water species, has not been found here, but is met with in other similarly situated ponds on the island. Among the above-mentioned sub-brackish pools we find the following undoubted fresh-water species:—

Cypris compressa,	in 9 of the ponds,	more or less common.
„ *granulosa,* sp. nov,	in 1 of the ponds,	moderately common.
„ *tesselata,*	in 5 of the ponds,	more or less common.
„ *lævis,*	in all „	more or less common.
	and in 1 „	exceedingly abundant.
„ *ovum,*	in 1 „	moderately common.
„ *gibba,*	in 1 „	rare.
„ *incongruens,*	in 2 „	moderately rare.
„ *obliqua,*	in 5 „	more or less common.
Cypridopsis villosa,	in 2 „	moderately rare.
Condona albicans,	in 3 „	moderately rare.
„ *detecta,*	in 5 „	moderately common.
„ *candida,*	in 3 „	moderately common.
„ *Kingsleii,*	in 3 „	moderately rare.
Notodromas monachus,	in 3 „	moderately common.
Limnicythere inopinata,	in 1 „	rare.

Others might be added from other brackish localities—amongst them *Cypridopsis vidua, Cypris fusca,* and *Cypris reptans.* From the circumstance that these species are uniformly inhabitants of inland fresh water, although occasionally found in brackish water, we cannot call them "brackish" species, and scarcely even "sub-brackish" species; but that they can accommodate themselves to either habitat there can be no doubt.

We thus see that, independently of the saline element, some ponds are more favourable to certain species of Ostracoda than others, and we may reasonably assume that different species are in some degree influenced by the different growths of the vegetation of the ponds during the season. This holds true in regard to other orders of the Microzoa. And it is a fact, howsoever we may explain it, that scarcely any two of these ponds are alike in the vegetation which they support, so that the causes of difference between them, whatever it may be, influences the plant as well as the animal life.

These observations require to be followed out over a more extended area, and a larger accumulation of facts obtained before any satisfactory conclusions can be arrived at. Hitherto there has been but little done in this department of Natural History in Scotland, and few to lead or assist. For these reasons it has been in a great measure overlooked, and other branches of a more popular kind preferred.

It may be useful to refer to a few of the places which have yielded the best results both in variety and abundance of species of Ostracoda, as it frequently happens, when information is derived only from maps, or from persons unacquainted with this class of organisms, that the collector is left wholly uncertain as to the suitability of a locality for his pursuit. Many fine sheets of water are quite barren of Ostracoda, or nearly so, while, on the other hand, they are often abundant in places where such organisms might be least expected.

Govan Colliery Dam, a short distance east of Crosshill, Glasgow, may almost be mentioned as a thing of the past. There can be no doubt that, considering the demand for suburban ground for building purposes, this small patch of water, so accessible from the city, and which has yielded for years many fine gatherings of various species of Ostracoda, will shortly be filled up and disappear. It has yielded the following species:—

Cypris gibba,	Ramdohr.
——— *lævis*,	Müller.
——— *compressa*,	Baird.
——— *virens*,	Jurine.
——— *reptans*,	Baird.

Cypridopsis obesa,	Brady & Robertson.
Candona candida,	Müller.
———— *nitens,*	Sp. nov.
———— *compressa,*	Koch.
———— *detecta,*	Müller.
———— *albicans,*	Brady.
———— *similis,*	Baird.
Limnicythere inopinata,	Baird.

Hairmyres, two miles west of East Kilbride, is an old limestone quarry, in disuse for upwards of twenty years, and mostly grown over with moss and varied species of pondweed. Amongst this pondweed Ostracoda are moderately plentiful. Some parts are very ochreous, yet there the Ostracoda are not uncommon and in fine condition. The following species are generally met with:—

Cypris fusca,	Straus.
——— *compressa,*	Baird.
——— *striolata,*	Brady.
——— *granulosa,*	Sp. nov.
——— *lævis,*	Müller.
——— *tessellata,*	Fischer.
Candona compressa,	Koch.
——— *albicans,*	Brady.
——— *candida,*	Müller.
——— *diaphana,*	B. & R.
——— *hyalina,*	B. & R.
——— *Kingsleii* (male),	B. & R.

Possil Marsh, or *Loch,* about three miles north of Glasgow, is of considerable extent, with both hard and swampy margins, and mostly well grown up with vegetation, though at the same time there is a large portion of clear water. At the north end a number of weedy, stagnant ditches are connected with the loch, and far exceed it in richness and variety of Ostracoda. This is one of those places where, when judging from appearance, we expect much but get little. The following species are from the marsh and ditches:—

Cypris fusca,	Straus.
——— *tessellata,*	Fischer.
——— *lævis,*	Müller.

Cypris striolata,	Brady.
——— *compressa,*	Baird.
——— *reptans,*	Baird.
Cypridopsis vidua,	Müller.
——— *obesa,*	B. & R.
Notodromas monachus,	Müller.
Candona candida,	Müller.
——— *detecta,*	Müller.
——— *similis,*	Baird.
——— *diaphana,*	B. & R.
——— *Kingsleii,*	B. & R.

Frankfield Loch, about four and a half miles east of Glasgow. No place could have a more promising appearance for Ostracoda. It covers about seven or eight acres, nowhere deep, and in most places it can be waded in. There is an abundance of marsh plants growing all over it, and the margins are grassy, with many ditches filled with vegetation, which harbour a fair proportion of Ostracoda and other Microzoa.

Cypris fusca,	Straus.
——— *reptans,*	Baird.
——— *virens,*	Jurine.
——— *tessellata,*	Fischer.
——— *lævis,*	Müller.
——— *compressa,*	Baird.
——— *granulosa,*	Sp. nov.
Cypridopsis vidua,	Müller.
——— *villosa,*	Jurine.
Candona detecta,	Müller.
——— *candida,*	Müller.
——— *nitens,*	Sp. nov.
——— *compressa,*	Koch.
——— *Kingsleii,*	B. & R.
——— *albicans,*	Brady.

Woodend Loch, about three-quarters of a mile to the south of Gartcosh Station, on the Caledonian Railway, and seven miles east of Glasgow. This loch is nearly half a mile long, and about a quarter of a mile broad; the margins on the north-western side are flat and shallow, and overgrown with vegetation, chiefly grass; and this is, perhaps, the best side for the capture of Ostracoda.

The following species were taken, 5th June, 1878:—

Cypris fusca,	Straus.
——— *striolata,*	Brady.
——— *compressa,*	Baird.
——— *ovum,*	Jurine.
——— *lævis,*	Jurine.
——— *tumefacta,*	B. & R.
——— *reptans,*	Baird.
Cypridopsis vidua,	Müller.
Candona albicans,	Brady.
——— *detecta,*	Müller.
——— *nitens,*	Sp. nov.
——— *compressa,*	Koch.
——— *Kingsleii,*	B. & R.
——— *similis,*	Baird.

Johnston Loch, about 7 miles east of Glasgow, and a little to the north of Gartcosh Railway Station, is of a quadrangular form, and about a quarter of a mile each way. The greater part of the margin is covered with weed, and not very deep, and the bottom is hard for a considerable distance from the shore, affording good footing. No place could be more convenient for collecting Microzoa. *Daphniadæ* are in great abundance; *Hydrachna* and *Lynceidæ* are common. The species taken 3rd June, 1878, were—

Cypris fusca,	Straus.
——— *tessellata,*	Fischer.
——— *compressa,*	Baird.
——— *striolata,*	Brady.
——— *lævis,*	Müller.
——— *reptans,*	Baird.
Cypridopsis vidua,	Müller.
Notodromas monachus,	Müller.
Candona candida,	Müller.
——— *nitens,*	Sp. nov.
——— *detecta,*	Müller.
——— *Kingsleii,*	B. & R.
Limnicythere inopinata,	Baird.

Bishop Loch is about 7 miles east of Glasgow, near Gartcosh Station, and is nearly a mile in length by a quarter of a mile in breadth. A great part of the margin is covered with tall grass and other aquatic vegetation. The Ostracoda found in it are—

Cypris fusca,	Straus.
——— *tumefacta*,	B. & R.
——— *lævis*,	Müller.
——— *compressa*,	Baird.
——— *striolata*,	Brady.
Cypridopsis vidua,	Müller.
Candona candida,	Müller.
——— *detecta*,	Müller.
——— *nitens*,	Sp. nov.
——— *compressa*,	Koch.
——— *Kingsleii*,	B. & R.
——— *diaphana*,	B. & R.
Limnicythere inopinata,	Baird.
——— *Sancti-Patricii*,	B. & R.

The last two were got in a ditch close by the Loch.

Antermony Loch is 10 miles north-east of Glasgow, about a mile east of Miltown Station. It covers about 33 acres, and at its greatest depth is 20 feet. It shallows towards the sides, which are mostly hard and gravelly, but a large portion is swampy and grown over with tall grass. At different times of the year there are different crops of vegetation.

A day or two before my visit, heavy rains having fallen, the loch was much above its usual height, and, as it had been extremely dry some weeks before, it seemed very unfavourable for a successful take of Ostracoda, and so it turned out. One species only was very abundant—*Cypris tessellata*—but almost all young, and at this stage they were all coarsely marked. Although this gathering was rather poor, I have no doubt, from the appearance of the place, that if trials were made at favourable times good gatherings would be obtained. 4th November, 1878—

Cypris reptans,	Baird.
——— *tessellata*,	Fischer.
——— *lævis*,	Müller.
——— *compressa*,	Baird.
Cypridopsis vidua,	Müller.
Candona albicans,	Brady.

Candona detecta, - - -	Müller.
——— *candida,* - -	Müller.
Limnicythere inopinata, -	Baird.

Duddingston Loch, Edinburgh.—This loch is an irregular oval about three-quarters of a mile in length and about half as broad. The greater part of the margins are well covered with vegetation, and although soft and swampy at both ends, there is ample extent of hard borders both on the north and south sides to work from without inconvenience. The Ostracoda are rather above the average in number of species, including a few of rare occurrence. This abundance is all the more remarkable as the loch is well stocked with fish and frequented by swans, neither of which are considered favourable to the increase of Ostracoda. The species obtained are—

Cypris virens, - - -	Jurine.
——— *lævis and var.,* - -	Müller.
——— *compressa,* - - -	Baird.
——— *ovum,* - - -	Jurine.
——— *punctillata,* - - -	Norman.
——— *gibba,* - - - -	Ramdohr.
——— *reptans,* - - -	Baird.
Cypridopsis obesa, - - -	B. & R.
——— *vidua,* - - -	Müller.
——— *villosa,* - - -	Jurine.
Candona candida, - - -	Müller.
——— *lactea,* - - -	Baird.
——— *detecta,* - - -	Müller.
——— *compressa,* - -	Koch.
——— *albicans,* - - -	Brady.
——— *similis,* - - -	Baird.
——— *diaphana,* - -	B. & R.
——— *Kingsleii,* - -	B. & R.

Lochmaben, Dumfriesshire.—There are a number of lochs in this neighbourhood of easy access, and during a day's stay I had a few hauls in six of them. Mill Loch is close to the burgh, and is of considerable depth. It contains the far-famed "Vendace," which Sir William Jardine considered to be closely allied to the *Salmo albula* of Linné. The west end of the Loch is the most favourable for Ostracoda collecting, being shallow and weedy. The Year

Loch is a little to the west, and has a good flat weedy margin on the south side, rich in Microzoa. Still a little further westward is what is called the "Blind" or "Spectacle Loch." It is rather deep round the edges, and overgrown with water-lilies; and I am much inclined to support Dr. Brady's opinion, that where lilies are plentiful Ostracoda are scarce. On the eastern side, close to the village, we have "Kirk Loch," said to cover 50 acres. It did not seem to promise well on the side we were on, and only a few trials were made, which did not yield much. A little to the east is "Castle Loch," which is of considerable extent, being said to be three miles in circumference, and to cover above 150 acres. Like other large lochs, the margins are too much dashed by the waves to favour the growth of weed suitable to harbour Ostracoda. At some little distance to the north east is "Broomhill Loch," or, as it is called by some, "Loch Broom." This is also a large loch, but, unlike some of the others, has a great extent of low weedy margin favourable to the growth of Ostracoda. Amongst the gatherings from this loch were *Cypris cinerea* and *Darwinella Stevenstoni*, new to Scotland. The following were obtained from the six lochs on 16th July, 1879:—

Cypris fusca,	Straus.
—— *virens*,	Jurine.
—— *tumifacta*,	B. & R.
—— *lævis*,	Müller.
—— *striolata*,	Brady.
—— *ovum*,	Jurine.
—— *compressa*,	Baird.
—— *granulosa*,	Sp. nov.
—— *cinerea*,	Brady.
—— *reptans*,	Baird.
Cypridopsis vidua,	Müller.
—————— *villosa*,	Jurine.
Notodromas monachus,	Müller.
Potamocypris fulva,	Brady.
Candona candida,	Müller.
——— *detecta*,	Müller.
——— *albicans*,	Brady.
——— *compressa*,	Koch.
——— *Kingsleii*,	B. & R.

Candona euplectella,	Sp. nov.
Darwinella Stevensoni,	B. & R.
Cytheridea lacustris,	G. O. Sars.

Callum's Tarn.—This is on the south-east end of Bute, about a quarter of a mile northward of Callum's Bay, on the eastern side of Callum Glen, 380 feet or so above the sea-level. The tarn is about 200 yards long, and 50 broad, and is well filled with vegetation. The greater part of the eastern side is firm turf, the two ends and western side are softer, but can be worked with little difficulty, and are the richest in Ostracoda. There are three other smaller tarns on the same ridge towards the south, and another, a short distance from the first, towards the north. These I have found of little consequence—still they are worth a trial, for different seasons gave different results, as below:—

9th August, 1879.		2nd November, 1878.	
Cypris lævis,	Müller.	*Cypris lævis,*	Müller.
—— *compressa,*	Baird.	—— *granulosa,*	Sp. nov.
—— *striolata,*	Brady.	—— *striolata,*	Brady.
—— *obliqua,*	Brady.	—— *obliqua,*	Brady.
—— *tessellata,*	Fischer.	—— *tessellata,*	Fischer.
—— *reptans,*	Baird.	—— *gibba,*	Ramdohr.
Cypridopsis villosa,	Jurine.	—— *virens,*	Jurine.
Notodromas monachus,	Müller.	*Cypridopsis villosa,*	Jurine.
Candona candida,	Müller.	*Candona candida,*	Müller.
—— *detecta,*	Müller.	—— *detecta,*	Müller.
—— *euplectella,*	Sp. nov.	—— *euplectella,*	Sp. nov.
Limnicythere inopinata,	Baird.	—— *albicans,*	Brady.
		—— *compressa,*	Baird.
		—— *Kingsleii,*	B. & R.
		—— *diaphana,*	B. & R.

Craigengower Tarn, on the hill-side, south of Craigengower farm, Cumbrae. This patch of water may be about 30 yards long, by about 15 broad. It is well covered with vegetation. The tarn is tolerably firm round the margins, and may be 2 or 3 feet deep towards the middle. Spiders and beetles are in abundance, and at all times it may be calculated upon to yield a gathering of Ostracoda of more or less interest, such as—

Cypris striolata,	Brady.
—— *lævis,*	Müller.
—— *obliqua,*	Brady.
—— *reptans,*	Baird.

Cypridopsis villosa,	Jurine.
Notodromas monachus,	Müller.
Candona candida,	Müller.
——— *detecta,*	Müller.
——— *hyalina,*	B. & R.
——— *Kingsleii,*	B. & R.
——— *similis,*	Baird.

Lewis and Skye.—These islands, so far as can be judged from a brief excursion, are far from being good hunting ground for fresh-water Ostracoda. Although lochs and tarns are in abundance they are mostly in peat, which, from its acidulous properties, does not favour the development of those animals possessing a calcareous covering. Besides, there is a great sameness in the character of the lochs, the product of one being nearly like that of a dozen others, and it is only now and again that we happen to find one of a different mineral character. It is chiefly to the flat ochreous marshes and roadside ditches that we owe our best results.

LEWIS.

Cypris lævis,	Müller.
—— *compressa,*	Baird.
—— *granulosa,*	Sp. nov.
—— *virens,*	Jurine.
—— *salina,*	Brady.
Cypridopsis villosa,	Jurine.
Potamocypris fulva,	Brady.
Candona candida,	Müller.
——— *detecta,*	Müller.
——— *Kingsleii,*	B. & R.
Cytheridea torosa,	Jones.

SKYE.

Cypris ornata,	Müller.
—— *reptans,*	Baird.
—— *lævis,*	Müller.
—— *compressa,*	Baird.
—— *gibba,*	Ramdohr.
—— *obliqua,*	Brady.
Cypridopsis villosa,	Jurine.
——— *aculeata,*	Lilljeborg.
Potamocypris fulva,	Brady.
Candona sp. ?	
——— *detecta,*	Müller.
——— *candida,*	Müller.
——— *Kingsleii,*	B. & R.

LIST OF SPECIES.

POTAMOCYPRIS FULVA, *Brady.*

Bardia fulva, Brady. *Monog. Recent Brit. Ost.*, p. 474, pl. xxviii., fig. 21.

——— Brady & Robertson. *Ann. and Mag. Nat. Hist.*, ser. iv., vol. iii., p. 365, pl. xviii., figs. 1-4.

Potamocypris fulva, Brady. *Nat. Hist. Trans. Northumberland and Durham,* vol. iii., p. 365, pl. xiv., fig. 4.

——— Brady, Crosskey, and Robertson. *Monog. Post-ter. Entom.*, p. 130, pl. 1, figs. 20-24.

Rather rare—Garnock old water-course, Kilwinning (J. Smith); Montrose Basin; Scarpa Floe, Orkney (D. O. Drewit); Hillerhurst Old Quarry, Kilwinning; side of Glasgow and Paisley Canal; the islands of Lewis and Skye.

CYPRIS FUSCA, *Straus*.

Cypris fusca, Straus-Durckheim. *Mem. du Mus. d'Hist. Nat.*, vol. vii., p. 59.
———*pilosa*, (?) Müller. *Entomostraca*, p. 59, tab. vi., figs. 5-6.
———*oblonga*, Brady. *Ann. and Mag. Nat. Hist.* (1864), vol. xiii., p. 59, pl. iii., figs. 1-4; and *Trans. Tyneside Nat. Field Club*, vol. vi., p. 104, pl. ii., figs. 1-4.
Candona hispida, Baird, *Brit. Entom.*, p. 161, tab. xix., fig. 4.
Cypris fusca, Brady, *Mon. Rec. Brit. Ost.*, p. 362, pl. xxiii., figs. 10-15.

Not uncommon in ponds, lochs, and shallow ditches, all the year round. Common in Frankfield Loch, near Glasgow, and in brackish ponds in Cumbrae. In a ditch in a plantation about a mile from Bothwell, on the Bellshill Road, the species was found in great abundance, together with a few of a long variety. Common in the lochs of Lochmaben.

In confinement they are occasionally very active, swimming about, and sometimes coming up and resting on the side of the vessel. At other times, although plentiful in the gathering, scarcely one is seen till they have been a day or two in confinement.

CYPRIS INCONGRUENS, *Ramdohr*.

Cypris incongruens, Ramdohr, *Ueber die Gattung Cypris; der naturforsch. Freunde zu Berlin Magazin*, 2 Jahrg., 1808, p. 86. Lillj., *De Crust. ex ord. trib.*, p. 119. Brady, *Mon. Rec. Brit. Ost.*, p. 362.
Cypris aurantia, Jurine. *Brit. Entom.*, p. 159, tab. xiv., fig. 13.
Monoculus aurantius, Jurine. *Hist. des Monocles*, p. 173.
——— *ruter*, Jurine. *Op. cit.*, p. 172.

Found not unfrequently on bottom mud of lochs and ponds; common in Lochend Loch and Gartcosh Loch, east of Glasgow; very abundant in a brackish lagoon on Hunterston shore, Ayrshire; moderately common in a greenhouse tank, Cumbrae; also in the bottom mud of a mill cooling pond, Paisley. Where the water issued into the pond, the temperature was 90° Fahr. and the surface water 80° Fahr., and they were found in the mud furthest from the heat. The only other Ostracod seen was *Cypridopsis vidua*, which was abundant at a grassy margin where the heat was 85°

Fahr., none being found in the cooler mud. On the other hand, none of *C. incongruens* were found at the margins in the greater heat with *C. vidua*. *C. incongruens* swims briskly through the water in confinement. When brought to the side with the brush, it shuts its valves and ceases to move, making no attempt to escape, and seldom resuming action for some time.

CYPRIS VIRENS, *Jurine.*

Cypris virens, Lillj. *De Crust. ex ord. trib.*, p. 117.
———— Brady. *Mon. Rec. Brit. Ost.*, p. 364.
———— Brady, Crosskey, and Robertson. *Mon. Post-ter. Ent.*, p. 124.
Monoculus virens, Jurine. *Hist. de Monocles*, p. 174.
Cypris tristriata, Baird. *Brit. Entom.*, p. 152.

A common species in ponds and ditches, sometimes in ponds more or less brackish, above high-water mark. In confinement it swims with great briskness, yet it is easily brought to the side with a camel-hair pencil, and lies motionless for a time before resuming its activity. When left on the surface of the water it seems to have little power to go down again. When attempting to swim on the surface, it goes round and round in a very circumscribed circle, appearing at times as if turning on a pivot; yet when under water it makes frequent curves and deflections. It can swim in straight lines, but apparently not with the same speed. When swimming, all the feet, as well as the antennæ, appear to be in motion. The colour is generally green, but subject to much variation from that colour to greenish drab—in some cases banded or mottled with greenish black.

CYPRIS OBLIQUA, *Brady.*

Cypris obliqua, Brady. *Mon. Rec. Brit. Ost.*, p. 364.

Common in tarns and ponds. In great abundance in a tarn on the hill above Callum's Bay, south-east end of Bute; abundant and dark in colour in an old quarry hole, subject to the spray of the sea, Cumbrae; but when the gathering was taken, the water was nearly dried up, and the weed all in a state of decay. Common in a tarn on a hillside on Craigengower farm, and all bright green. In a gathering at Glen Helen, Isle of Man, the colour being a fine brown; Isle of Skye moderately common.

CYPRIS ORNATA, *Müller.*

Cypris ornata, Müller. *Zool. Dan. Prodrom.*, 2391. *Entom.*, p. 51. Lillj., *De Crust.* tab. x., figs. 19-22. Brady, *Nat. Hist. Trans. Northumberland and Durham*, vol. iii., p. 364.
Monoculus ornatus, Jurine. *Hist. des Monocles*, p. 120.

Locally common. Abundant in a very small, shallow ditch, Cumbrae, in fine condition, all of a cream colour, with dashes of green and orange, March 18. Plentiful in a small patch of water at Thorntonhall, near Busby, April 12. In a ditch in a plantation near Bothwell, May 24. Little Loch, Ayrshire (J. Smith). In this loch the specimens were small, not young-like, but stunted, and unusually dark in colour. Isle of Skye, moderately common, Aug. 18. Burnside Loch, about a mile south-east of Rutherglen, common and in good condition, Nov. 22. The ground colour of this species varies considerably.

CYPRIS TUMEFACTA, *Brady and Robertson.*

Cypris tumefacta, Brady and Robertson. *Ann. and Mag. Nat. Hist.*, s. 4., vol. vi., pl. iv.

Moderately common, but rather local. Loch Goin and the Garnock old water-course, Eglinton Iron-works (J. Smith); Bishop and Woodend Lochs, moderately common; Blue Loch on ferruginous grassy margin, rare; common in ferruginous ditches beside Eddleston Water, at Railway Station, Peebles, 6th June; Mill Loch and Castle Loch, Lochmaben, more or less common, 16th July.

CYPRIS PUNCTILLATA, *Norman.*

Cypris punctillata, Norman. *Ann. and Mag. Nat. Hist.*, Jan., 1862, p. 43. Brady. *Mon. Rec. Brit. Ost.*, p. 365.
——— *cuneata*, Baird. *Proc. Zool. Soc. Lond.*, 1850, p. 255.

Found in Duddingston Loch, Edinburgh (Dr. Baird); since on several occasions in the same loch (D. R.); Linlithgow Loch in the month of September. Rather rare in Scotland, and smaller than the English specimens I have seen.

CYPRIS TESSELATA, *Fischer.*

Cypris tessellata, Fischer. *Mem. des Sar. Etrangers*, St. Petersburg, vol. vii., p. 159; Brady, *Mon. Rec. Brit. Ost.*, p. 366.
——— *affinis*, Lillj. *De Crust. ex ord. trib.*, p. 46; Brady, *Ann. and Mag. Nat. Hist.*, 1864, vol. xiii., p. 60.

Not uncommon. Moderately common in old sand quarry subject to the spray of the sea, Cumbrae. Common in Johnston Loch (June), and Mugdock Loch (October); Antermony Loch (October), very common, but all immature. Dr. Brady says that it is his experience to find this species haunting small grassy pools where the water is considerably impregnated with organic matter.* This appears also to be the case, to some extent, on our side of the border; yet it is frequently met with in lochs of considerable extent.

CYPRIS SALINA, *Brady*.

Cypris salina, Brady. *Mon. Rec. Brit. Ost.*, p. 368.
——— Brady, Crosskey, and Robertson. *Mon. Post-ter. Entom.*, p. 124.
——— *strigata*, Baird. *Brit. Entom.*, p. 157.

Not uncommon in brackish water. Common in a pond on the Hunterston shore, opposite Millport, subject to the spray of the sea. Moderately common in a pond at Ferry House, Cumbrae, now filled up, where the *confervæ* of the pond were washed up a foot or more by the waves of the sea during a storm at high tides. Yet, after the subsidence of the storm, this species, together with *Cypris aculeata*, was found to have kept its place, being still plentiful. This pond was very small, not covering more than two superficial poles, and must have been quite salt when covered by the sea; yet in the dry season of the year, being supplied by a drain, it must have been comparatively fresh. In brackish water, Lewis.

CYPRIS GIBBA, *Ramdohr*.

Cypris gibba, Ramdohr. *Mag. und Gesellch. naturforsch. Freunde zu Berlin*, ii., p. 91.
——— Jones. *Mon. Ent. Ter. Form.*, p. 15.
——— Brady. *Mon. Rec. Brit. Ost.*, p. 369.
——— Brady, Crosskey, and Robertson. *Mon. Post-ter. Entom.*, p. 127.
? *Cytherina expansa*, Reur. *Haidinger's Abhandl.* Band iii., p. 60.

Not uncommon in fresh-water gatherings. Although a *Cypris*, its true habitat appears to be in the mud at the bottom. A gathering from a clay hole at Portobello, near Edinburgh, sent me by Mr. James Bennie, was crowded with this species. It is also common in Dunsapie Loch, Arthur's Seat, Edinburgh. This species is of a cream-colour or a dirty white. In a ditch at Rowan Bridge, on the side of Glasgow and Paisley Canal, the greater number were greenish. In Govan Colliery Old Dam they had all a fine reddish tinge, as was also the case at Craiglockhart Curling Pond, near Edinburgh.

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* *Mon. Rec. Brit. Ost.*, p. 366.

CYPRIS STRIOLATA, *Brady.*

Cypris striolata, Brady. *Ann. and Mag. Nat. Hist.*, 1864, vol. xiii., p. 60; and *Mon. Rec. Brit. Ost.*, p. 372.

Moderately common amongst muddy roots of vegetation and bottom mud. In Loch Libo and Johnstone Loch, rather common, but in poor condition. Common in an old ferruginous limestone quarry, Hairmyres. Abundant in an upper reach of a mill-dam at Cadder Wilderness, where the water does not all draw off; the bottom was all soft black mud with a little weed and confervæ, and many decaying leaves from overhanging trees; the water did little more than cover the mud, all having a very unclean aspect. Common on Upper Braid Farm Loch, near Edinburgh. In this patch of water the shells of many were so soft and flexible that they were more or less corrugated or dimpled. Very fine and well marked in Pendreich Dam, Bridge of Allan.

This species is closely allied to *Cypris compressa*, but rather larger, and generally of a darker purplish colour, and less shining. It is readily distinguished by the fine striæ on the shell, yet in some cases this is only seen under a good microscope. It comes still more closely to *Cypris granulata, sp. nov.*, which is smaller and paler in colour.

CYPRIS COMPRESSA, *Baird.*

Cypris compressa, Baird. *Brit. Entom.*, p. 154. Lillj. *de Crust., ex. ord. trib.*, p. 112. Brady, *Mon. Rec. Brit. Ost.*, p. 372. Brady, Crosskey, and Robertson, *Mon. Post-ter. Ent.*, p. 123.
——— *punctata*, Zenker. *Anat.-Sys. Stud. über die Krebsthiere*, p. 77.

Frequent in ponds and ditches, and occasionally in brackish water; chiefly in the mud at the bottom, and sometimes under varied circumstances. Generally in pure water, but also where it is quite otherwise. In a gathering at the Port-Eglinton Terminus, of the Glasgow and Paisley Canal, they were common where the water was covered with floating oil from the refuse of neighbouring factories, and the mud from which they were dredged was of the most offensive character. At Oban, moderately common in brackish water in company with *Cypridopsis aculeata.* In Johnstone Loch. In an old limestone quarry where the water was very shallow. In an old dried-up dam, with only as much water as formed a soft mud. In Craigengower tarn, Cumbrae. In Blae Loch, near Lugton Station, and at Hairmyres old limestone quarry. When in confinement they swim through the water with great alertness. Like many of the same family, when touched with a hair pencil they withdraw within their shells, but not so readily as some of their allies do, for they make some attempt to escape. When left undisturbed they soon again resume their activity. This species, together with other smooth-shelled Ostracoda, when stirred up to the surface, float seemingly with little power to go down into the water again. Dr. Baird,* speaking of the Cypridæ, states that they seem to be "endued externally with a species of varnish to protect them from the action of the water, as whenever they rise to the surface the shell becomes perfectly dry, and floats there in spite of the animal's struggles to again immerse itself." This is true to a great extent when they are confined in a glass or earthenware vessel. A dozen of *Cypris compressa* were put on the surface in a wine glass on 8th March, and on 28th May, they were still on the surface and alive, although they had a weakly appearance. None had got to the side of the glass, although clustered together in small groups; when brought to the side of the vessel they were repelled from it, whereas inanimate chips of matter were drawn to it. On the other hand, they could readily take hold of any plant met with in the water, and in this way could readily regain immersion. They did not seem to come to the surface of their own accord, but apparently only when brought there under accidental circumstances.

CYPRIS GRANULATA, *sp. nov.*

Found in an old Limestone Quarry, Hairmyres, one and a half miles west of East Kilbride. April 15th.

In Frankfield Loch. May 1.

In Duddingston Loch. June 15.

An old furrow in pasture ground, Stobs, near Kilwinning, June 22.

**Nat. Hist. Brit. Entom.*, p. 144.

In Mugdock Loch, near Milngavie. Oct. 1.
In a brackish pond, No. 4, Cumbrae.
In Blae Loch. May 30.
In Lewis and Skye. July 31.

CYPRIS LÆVIS, *Müller.*

Cypris lævis, Müller. *Entom.*, p. 52. Brady. *Mon. Rec. Brit. Ost.*, p. 374.
———— Brady, Crosskey, and Robertson. *Mon. Post-ter. Ent.*, p. 126.
—— *pantherina*, Fisher. *Ueber das genus Cypris*, p. 163.
—— *ovum*, Lillj. *De Crust.*, p. 113.
———— Jones. *Mon. Ter. Ent.*, p. 14.
Cypria ovum, Zenker. *Anat.-Sys. Stud.*, p. 70.

Common everywhere in summer and winter. Some years ago it was in great abundance in a hothouse tank containing the Victoria Lily in the Botanic Gardens, Glasgow. The creatures had perforated the broad leaves of the plant like a sieve, and had laid their eggs to the number of 3 to 4 in each perforation. The eggs were of a transparent greyish colour, and in their advanced stage showed the shell well formed. The heat of the water in the tank ranged about 70° Fahr. Also abundant in a gathering taken under the ice in a tarn on Craigengower Farm, Cumbrae, in the month of January.

No other species that I know of in this country is occasionally found in such numbers. In a roadside pond thickly matted with weeds, at Glen-Helen, Isle of Man, in a few minutes' gathering I had more than filled a half-ounce phial of this species alone, and a similar gathering was obtained in a tarn on the south-east end of Bute. Although these creatures may be found abundantly at one time, yet at another they may be comparatively rare in the same pond.

CYPRIS OVUM, *Jurine.*

Cypris ovum, Brady. *Mon. Rec. Brit. Ost.*, p. 373.
———— Brady, Crosskey, and Robertson. *Mon. Post-ter. Entom.*, p. 155.
Monoculus ovum, Jurine. *Hist. des Monocles*, p. 179.

This species appears to be more common in England than in the west of Scotland. It is apt to be mistaken for *C. lævis*, but when looked at from above is seen to be more elliptical and less tumid. It is met with in lochs, ponds, and canals, moderately common; in a group of marsh ponds on the west side of Houston (Crosslees) Railway Station; and in Duddingston Loch, Edinburgh.

CYPRIS CINEREA, *Brady.*

Cypris cinerea, Brady. *Mon. Rec. Brit. Ost.*, p. 374.

Broomhill Loch, Lochmaben, moderately common, July 16 (D.R.). Mickle Fell, Yorkshire, at an elevation of 2000 feet (Dr. Brady). Lewis, at an elevation of 600 feet (D. R.).

CYPRIS REPTANS, *Baird.*

Cypris reptans, Lillj. *De Crust.*, p. 123.
———— Brady. *Mon. Rec. Brit. Ost.*, p. 370.
———— Brady, Crosskey, and Robertson. *Mon. Post-ter. Entom.*, p. 123.
Candona reptans, Baird. *Trans. Berw. Nat. Club*, i., p. 99; and *Brit. Entom.*, p. 167.
———— Jones. *Mon. Ter. Entom.*, p. 16.

Moderately common amongst the roots of vegetation, and occasionally in the mud at the bottom, but apparently at no great depth. Excessively abundant in the month of May in the old dam that supplies the engine of the Govan Colliery. They were rather thin, and of a bright green colour, with very little of the usual clouding. The pond was covered at the time with old matted green *confervæ.*

CYPRIDOPSIS VIDUA, *Müller.*

Cypridopsis vidua. Brady. *Mon. Rec. Brit. Ost.*, p. 375.
Cypris vidua, Müll. *Entom.*, p. 55.
———— Baird. *Brit. Entom.*, p. 152.
———— Lillj. *De Crust. ex ord. trib.*, p. 111.
——*sella*, Baird. *Brit. Entom.*, p. 158.
Monoculus vidua, Jurine. *Hist. de Monocles*, p. 175.

This well-marked species is common in lochs, tarns, and canals, but is rather local. It is not in any of my gatherings from either Lewis or Skye. Common in Glasgow and Paisley Canal; Loch Fad, Bute; Duddingston Loch, Edinburgh; Mill Loch, Lochmaben. In great abundance in a cooling pond at Mr. Barr's turning works, Paisley, the temperature of the water being 85° Fahr. In a jar that I had kept for ten days the water had acquired a strong offensive smell from plant and animal decomposition, yet this species seemed to all appearance in good health; the only other Entomostracan that had survived with it was *Cyclops quadricornis.* In confinement it makes little or no effort to escape when pursued, allowing itself unresistingly to be pushed to the side with a hair pencil. The young, when viewed from above, are more compressed posteriorly than the adult; at this stage the dark bands are absent or nearly so.

CYPRIDOPSIS VILLOSA, *Jurine.*

Cypridopsis villosa, Brady. *Mon. Rec. Brit. Ost.*, p. 377.
Monoculus ———, Jurine. *Hist. des Monocles*, p. 178.
Cypris Westwoodii, Baird. *Brit. Entom.*, p. 156.
? *Cypris elongata*, Baird. *Brit. Entom.*, p. 156.

Found in a small creek of Lochlomond at Luss; in a small pond near Banff; in Frankfield Loch, near Glasgow; in Loch Libo, near Dalry; in Fullwood, Hairlaw, and Craiglaw Dams; in all moderately rare. Also in a number of the ponds along the shores of Cumbrae, subject to the spray of the sea. Moderately common in the Isles of Skye and Lewis. Common in lochs of Lochmaben. This species appears to be more a mud than a plant dweller. The young have few or no hairs on the carapace, and are much smaller, posteriorly, than the adult.

CYPRIDOPSIS ACULEATA, *Lillj.*

Cypridopsis aculeata, Brady. *Mon. Rec. Brit. Ost.*, p. 376.
Cypris aculeata, Lillj. *De Crust. ex ord. trib.*, p. 117.
——————— Norman. *Ann. and Mag. Nat. Hist.*, 1862, vol. ix., p. 44.

Frequents water more or less brackish. It was abundant in a pool at Ferry House, Cumbrae, now filled up. This pond was just at the edge of high-water mark, and subject to the overflow of the sea during storms and high tides. Also in brackish pools along the shores of the south-west end of Cumbrae. Isle of Skye. When confined they cluster together on bits of floating algæ, appearing like batches of small mussels.

CYPRIDOPSIS OBESA, *Brady and Robertson.*

Cypridopsis obesa, Brady and Robertson. *Ann. and Mag. Nat. Hist.*, ser. iv., vol. iii., pl. xviii.; and vol. vi., p. 19.
——————— Brady, Crosskey, and Robertson. *Mon. Post-ter. Entom.*, p. 128.

Rather sparingly distributed in Scotch localities. Moderately rare in Lochend and Duddingston Lochs, Edinburgh; Lochlomond, rare; moderately common in the old dam that supplied the water to the Govan Colliery, Glasgow; Loch Libo, rare.

CYPRIDOPSIS NEWTONI, *Brady and Robertson.*

Cypridopsis Newtoni, Brady and Robertson. *Ann. and Mag. Nat. Hist.*, ser. iv., vol. iv., p. 14.
———— Brady, Crosskey, and Robertson. *Mon. Post-ter. Entom.*, p. 129.

Moderately common in Fullwood Dam.

Little Loch, and Pilmuir Dam. In a small pond a little above high water, Cumbrae, and in Hayton Dam, Peebles.

GONIOCYPRIS MITRA, *Brady and Robertson.*

Goniocypris mitra, Brady and Robertson. *Ann. and Mag. Nat. Hist.*, ser. iv., vol. vi., July, 1870, pl. xii.

So far as yet known this species has only been found in Scotland in Lochend Loch, Edinburgh. A parcel of mud which was sent me by Mr. James Bennie, contained some single valves of it. In hopes to procure living examples I made a further search, but failed to find any but dead shells. The loch at this time was being drained and filled up with rubbish from the town, which gives reason to suspect that the species had been killed by the poisonous nature of the refuse. The process of filling up has been abandoned, and the loch has been full of water for some time. I have tried for the same species since, but without finding a trace of it. That may arise, however, not from its extinction in the loch, but because the former gatherings were from mud in very low water, when the loch was partially drained, and the latter from the high margins when the loch was in flood. A boat and dredge may now be required to obtain it.

NOTODROMAS MONACHUS, *Müller.*

Notodromas monachus, Lillj. *De Crust. ex ord. trib.*, p. 95.
———— Brady. *Mon. Rect. Brit. Ost.*, p. 379.
Cypris monocha, Müll. *Entom.* (1785), p. 60.
———— Baird. *Brit. Entom.*, p. 153.
Monoculus monachus, Jurine. *Hist. des Monocles*, p. 173.

Not uncommon in grassy ponds and tarns. On Great Cumbrae in ponds along the shore subject to the spray of the sea. Loch Libo, rather rare and small. Lochs of Lochmaben, moderately common. This species is rather local in its distribution in Scotland, besides being inconstant in its haunts. Many years ago it was in great abundance in a tarn on Little Cumbrae. Although the same tarn has recently been searched over and over again, this species has been met with only sparingly on one or two occasions. In some of the brackish ponds along the shores of Great Cumbrae it has been met with plentifully in autumn, and in the same ponds on the following spring not one was to be seen—not even a vestige of their dead shells. This is the case occasionally with other species of Ostracoda, but not so markedly as has been noticed with *Notodromas monachus.*

CANDONA ALBICANS, *Brady.*

Candona albicans, Brady. *Ann. and Mag. Nat. Hist.,* vol. xiii., p. 61, pl. iv., figs. 6-10; *Trans. Tyneside Nat. F.C.,* vol. vi., p. 107, pl. iii., figs. 6-10; *Mon. Rec. Brit. Ost.,* p. 381, pl. xxv., figs. 20-25; and pl. xxxvi., fig. 12.
——————— Brady, Crosskey, and Robertson, *Mon. Post-ter. Entom.,* p. 133, pl. i., figs. 10-13.

Moderately common in Paisley Canal and Duddingston and Lochend Lochs, Edinburgh; common in Baron Loch, Mannor, Peeblesshire; very fine in Frankfield Loch; large and in beautiful condition in a wet furrow of old pasture land, Kilwinning; common in lochs of Lochmaben; one only in gatherings from Skye.

CANDONA LACTEA, *Baird.*

Candona lactea, Baird. *Proc. Zool. Soc. Lond.,* p. 255, pl. xviii., figs. 25-27.
————— Brady. *Mon. Rec. Brit. Ost.,* p. 382, pl. xxiv., figs. 55-58.
————— Crosskey, Brady, and Robertson. *Mon. Post-ter. Entom.,* p. 134, pl. i., figs. 14-16.

Found in Duddingston Loch, and Paisley Canal. This species appears to be rather rare in Scotland.

CANDONA EUPLECTELLA, *sp. nov.*

Found in Callum's Tarn, Bute. In tarn on Little Cumbrae. In Year Loch, Blind Loch, and Broomhill Loch, Lochmaben.

CANDONA COMPRESSA, *Koch.*

Cypris compressa, Koch. *Deutschlands Crustaceen,* H. 21, pl. xvii.
Candona compressa, Lillj. *De Crust. ex ord. trib.,* p. 129, tab. xxvi., figs. 1-3.

Cypris setigera, Jones. *Mon. of Tert. Entom.*, p. 12, pl. 1., figs. 6a.-6d.
Candona compressa, Brady. *Mon. Rec. Brit. Ost.*, p. 382, pl. xxvi., figs. 22-26.

Not uncommon in Glasgow and Paisley Canal, Govan Colliery Dam, Hairmyres old quarry, Frankfield and Bishop Lochs, Duddingston and Lochend Lochs, Edinburgh; Mill and Year Lochs, Lochmaben; both Cumbraes and Bute.

CANDONA CANDIDA, *Müller.*

Cypris candida, Müller. *Entom.*, p. 62, tab. vi., figs. 7-9.
Monoculus candidus, Jurine. *Hist. de Monocles*, p. 176, pl. xix., figs. 7-8.
Candona lucens, Baird. *Brit. Entom.*, p. 160, tab. xix., fig. 1.
——— *candida*, Lillj. *De Crustaceis.*
——— Jones. *Ter. Entom.*, p. 19, pl. i., figs. 8a, 8f, 5a, 5p.
——— Brady, *Mon. Rec. Brit. Ost.*, p. 383, pl. xxv., figs. 1-9; pl. xxxvi., fig. 13; and pl. xxvii., fig. 1.
——— Crosskey, Brady, and Robertson, *Mon. Post-ter. Entom.*, p. 135, pl. ii., figs. 29-30.

Common nearly everywhere in lochs, ponds, and ditches. Not being a swimmer it is chiefly found in mud, yet it is by no means sluggish, as it may be seen scampering over and burrowing in and out of it. Met with both in deep and shallow water, and not unfrequently in water more or less brackish. In Lochlomond it has been found at a depth of 40 fathoms. Like some of its congeners, it is occasionally met with in water of very questionable quality. In a creek of the Leven, at Dumbarton, which is used as a kind of dock for timber, and apparently also as a receptacle for refuse of the neighbourhood, the black mud at the bottom, which had a most offensive odour, contained this species plentifully, and without the least appearance of sickliness.

CANDONA DETECTA, *Müller.*

Cypris detecta, Müller. *Entomostraca*, p. 49, tab. iii., figs. 1-3.
Candona ——— Baird. *Brit. Entom.*, p. 161.
——— Brady. *Mon. Rec. Brit. Ost.*, p. 384, pl. xxiv., figs. 35-38; and pl. xxxvii., fig. 2.
——— Brady, Crosskey, and Robertson. *Mon. Post-ter. Entom.*, p. 134, pl. 1., figs. 7-9.

In ponds, lakes, and ditches everywhere. Common in Glasgow and Paisley Canal and Frankfield Loch. In Loch Urie, Arran (J.

Campbell), 1250 feet above sea level. Common in a small pool in the little islet, the site of the vitrified fort in the Kyles of Bute; no other Ostracod being found in the same gathering. This pool is only a few feet above high-water mark, and a few yards in diameter, and must be subject to a considerable amount of spray. Also in great abundance in a newly dried-up pool, a little above high-water, on Hunterston shore, Ayrshire, on the damp mud, under a thick coat of dry moss. The only other species found with it were two examples of *Candona candida*, and three of *Cypridopsis aculeata.*

CANDONA SIMILIS, *Baird.*

Candona similis, Baird. *Brit. Entom.*, p. 162, pl. 19, figs. 2-2a.
——————— Brady and Robertson, *Ann. and Mag. Nat. Hist.*, ser. iv., vol. vi., p. 52, pl. 1, fig. 62.

Has been more generally met with in lochs than in smaller patches of water. Moderately common in Woodend and Lochend Lochs, near Glasgow, and in Burnbath Loch and Houston Dam, Bridge of Weir. Common in Duddingston Loch, Edinburgh.

CANDONA NITENS, *sp. nov.*

Found in Mugdock Loch, near Milngavie, moderately rare. Oct. 1st.

Johnstone Loch, moderately common. June 3rd.

Frankfield Loch, rare. May 1st.

Crosslee, moderately common. May 17th.

Bishop Loch, moderately common. May 30th.

Pilmuir Dam, Burnside Loch, Govan Colliery Dam, Hairlaw Loch—common.

CANDONA KINGSLEII, *Brady and Robertson.*

Candona Kingsleii, Brady and Robertson, *Ann. and Mag. Nat. Hist.*, ser. iv., vol. vi., p. 17., pl. ix., figs. 9-12.

Not unfrequently in both deep and shallow water. In Lochlomond in 12 to 20 fathoms. Baron Loch, Peebleshire; Frankfield Loch; Eaglesham Dam; Long Loch (J. Smith). Common in both Skye and Lewis. Lochearnhead (P. Cameron).

CANDONA DIAPHANA, *Brady and Robertson.*

Candona diaphana, Brady and Robertson. *Ann. and Mag. Nat. Hist.*, ser. iv., vol. vi., p. 18, plate v., figs. 1-3.

In Hairmyres and Lambriden old limestone quarries, moderately common; Mugdock Loch, near Milngavie; brackish pond, Millport.

CANDONA HYALINA, *Brady and Robertson.*

Candona hyalina, Brady and Robertson. *Ann. and Mag. Nat. Hist.*, ser. iv., p. 18, pl. ix., figs. 5-8; plate v., figs. 4-11.

In Frankfield Loch, St. German Loch, and Little Loch; Craigton Dam, and Possil Marsh; Hairmyres old limestone quarry, Dumfries.

DARWINELLA STEVENSONI, *Brady and Robertson.*

Polycheles Stevensoni, Brady and Robertson. *Ann. and Mag. Nat. Hist.*, vol. vi., p. 25, pl. vii., figs 1-7; and pl. x., figs. 4-14.
Darwinella ——— Brady and Robertson, *ib.*, vol. ix., p. 50.
——— ——— Brady, Crosskey, and Robertson. *Mon. Post-ter. Entom.*, p. 141, pl. ii., figs. 13-17.

At Loch Broomhill, Dumfriesshire, the only Scotch locality yet recorded.

LIMNICYTHERE INOPINATA, *Baird.*

Cythere inopinata, Baird. *Brit. Entom.*, p. 172, pl. xx., figs. 1, 1a-e.
Limnicythere ——, Brady. *Mon. Rec. Brit. Ost.*, p. 419, pl. xxix., figs. 15-18; pl. xxxviii., fig. 9; pl. xxxix., fig. 1.
——— Brady, Crosskey, and Robertson. *Mon. Post-ter. Entom.*, p. 173, pl. x., figs. 8-11.

Not unfrequently found amongst the mud in lochs, ponds, and canals. In Duddingston and Lochend Lochs, Edinburgh, St. German and Mugdock Lochs near Glasgow, Glasgow and Paisley Canal, moderately common.

The species is not rare, although not generally met with in consequence of being chiefly confined to the mud.

LIMNICYTHERE SANCTI-PATRICII.

Limnicythere Sancti-Patricii, Brady and Robertson, *Ann. and Mag. Nat. Hist.*, ser. iv., vol. iii., p. 17, pl. xviii., figs. 8-11; and pl. xxi., fig. 4.

In Loch Libo, rare; in a ditch at the side of Bishop Loch but not communicating with it.

CYTHERIDEA LACUSTRIS, *G. O. Sars.*

Cythere lacustris, G. O. Sars. *Zool. Reise i Sommeren*, 1863, p. 30.
Cyprideis torosa, Jones (in part). *Ter. Entom.*, p. 21, pl. ii., figs. 1*a*-1*d*; and woodcut, p. 16, fig. 2.

Cytheridea lacustris, Brady. *Mon. Rec. Brit. Ost.*, p. 427, pl. xxvi., figs. 18-21; and pl. xl., fig. 2.

Not uncommon in Glasgow and Paisley Canal, west of Pollokshields, and sparingly in the Clyde, near Langbank. This species is rather sluggish, mostly stationary on the mud, or partly embedded in it, with the valves partially open, apparently satisfying itself with what the movement of the water may bring in its way.

CYTHERIDEA TOROSA, *Jones.*

Candona torosa, Jones. *Ann. and Mag. Nat. Hist.*, ser. ii., vol. vi., p. 27, pl. iii., fig. 6.

Cyprideis torosa, Jones. *Mon. Ter. Ent.*, p. 21, pl. ii., figs. 1a-1i.; and woodcut, fig. 2, p. 16.

Cytheridea torosa, Brady and Robertson. *Ann. and Mag. Nat. Hist.*, ser. iv., vol. vi., p. 21, pl. viii., figs. 6-7.

——————— Brady, Crosskey, and Robertson. *Mon. Post-ter. Entom.*, p. 178, pl. xv., figs. 11-12. Var. *teres*, pl. vii., figs. 1-2.

In brackish water, chiefly estuarine. In great abundance on the banks of the Garnock on Misk Farm, near Kilwinning, in small holes, a few feet wide, formed in the turf, the bottom being soft mud covered by a few inches of water, and overflowed by high tides. The margins of those pools are excavated for many inches all round. Small eels, from three to four inches long, are common in the bottom mud.

Var. *teres*.—Generally in company with the above.

The following remarks may help beginners, who generally work at great disadvantage and loss of time from not knowing properly when or how to collect, or how to preserve what they may have collected. The latter is perhaps the greatest source of discouragement to many, who find, after a few years' enthusiastic labour, that they have only accumulated a vast amount of ill-arranged and often cumbersome material, neither pleasant to look upon nor useful to consult.

In this, as in all other branches of Natural History, it is absolutely necessary (1) to have the locality affixed to every specimen intended for preservation. To do this is within the reach of every one who collects for himself. If it is neglected to be done at the time of collection, it may be impossible to do it with any certainty afterwards. (2) The next important point is to have the name attached to the specimen upon the first opportunity, and not left merely to memory, and it then becomes a useful assistant in other determinations. (3) Every specimen which it is desirable to keep should be carefully laid past and arranged with others in the most convenient way for reference.

I shall indicate briefly—

(1) Where the Ostracoda are principally to be found.

(2) What season of the year is most favourable for procuring them.

(3) By what means they may best be secured.

(4) How to preserve them most conveniently for inspection and reference.

I. *Places where to be found.*—They are to be found in lakes, tarns, ponds, lagoons, canals, ditches, and often in very small patches of water, and in slow-running streams; but in the latter by no means commonly, except in weedy recesses protected from the currents, or where clumps of thickly-growing plants abound.

Nowhere, throughout Scotland, is there any want of such places either in number or variety, whether we regard the depth of water, varying from the thinnest covering to the deepest lakes, or their situations, ranging from the sea level to high mountain tarns; or the character of the basin in which they lie, rock, peat, clay, &c.; or, lastly, the impregnated mineral contents. Ostracoda are generally more abundant in the smaller tarns or ponds, overgrown with weeds, than in deep and large sheets of water, where the surging of the waves is unfavourable to marginal vegetation; yet I often find, that places greatly overgrown with plants are not always the richest in Ostracoda, but sometimes the reverse—probably in such cases by affording more suitable conditions to a greater host of enemies. Ostracoda are occasionally obtained in small tarns and ponds where the water has been nearly dried up, leaving only a little at some central depression; and even in the damp mud, whence the water has disappeared, good gatherings are met with, as well as in the scanty water of furrows in old pasture land, and which are dry during the greater part of the summer. It is indeed surprising, as regards many of these patches of water, how speedily after rain they are found swarming with Ostracoda and other Microzoa. In some instances it has been observed that, after the rains certain species are absent which had been present before the ponds dried up, while by next season they again become abundant. Whatever means of distribution there may be, it is very probable that this renewed life proceeds in a great measure from ova. That the ova retain vitality for a long time is certain. The late Dr. Baird, of the British Museum, showed Dr. G. S. Brady and myself a jar containing numerous forms of animal life which had made their appearance from mud taken from a dried-up canal in India during the hot season, and kept in the dry state for a considerable time after reaching this country before being subjected to water. Shortly after water was supplied, many living forms made their appearance. Where the pools are small and subject to be dried up during summer they seldom contain many species, although in such cases one species may prevail greatly. Limestone districts are favourable to Ostracoda, but all rock or clay surfaces are better than peat. Where there is nothing but pure peat, or peaty ponds fringed with *Sphagnum*, few or no Ostracoda may be expected. They are seldom searched for successfully where the lakes or pools have risen much by heavy rain-falls, nor in mill-dams, where the water is drained off rapidly, leaving broad, bare margins. It is otherwise where the water in the pools is decreasing gradually by evaporation. Then these animals appear to have time to follow the water, and may be taken abundantly when thus brought closer together in the small shallow pools left here and there. Moorland roadside ditches are more promising than those at some distance from the road. This may arise from a supply of material from the drainage of the road, which may be requisite to build up the shells of these minute crustaceans. Ostracoda are seldom absent in ditches or marshes which contain a little ochreous deposit with a metallic bluish scum on the surface of the water; they are more common in broad shallow ditches than in those more narrow and deep, and are rarely met with in springs or in ponds abounding with fish. Neither do they thrive where amphipods prevail. These little bivalve crustaceans are not always fastidious in their choice of habitat, sometimes disporting in pure fresh water, at other times revelling in water of very questionable character, while others affect brackish water, although they live in very different degrees of the saline element.

The Govan Colliery Dam, which is close to the terminus of a railway, is subjected to the dust from loading and unloading of the waggons, and to the deleterious fumes of a range of brick kilns within a dozen of yards or so, and is generally covered with a sprinkling of soot from the neighbouring factories. It is further the play pond for the children of the vicinity to sail their small boats upon. In spite of all these apparent disadvantages against the Ostracoda, I seldom fail to obtain a fair gathering of them in this small patch of water, whether in summer or winter. Their survival under all these circumstances may be that what is harmless and healthful to them may be death to their enemies. The *Cypridæ* proper are seldom if ever found in very deep water, but mostly amongst the vegetation, while the *Candonæ* are met with at greater depths. In Lochlomond I have found them at a depth of 40 fathoms. Although these small crustaceans appear to be greatly more abundant on the plains than on the mountains, Dr. G. S. Brady records *Cypris cinerea*, *C. compressa*, *C. striolata*, &c., from a pool near the summit of Mickle Fell in Yorkshire, at an elevation of 2000 feet.

From the foregoing it is evident that the abundance of these organisms in one place cannot always be taken as an index of their profusion in another, although the two may be of quite similar appearance. In the one, these forms of life may be swarming; in the other, absent or nearly so. So little can we depend upon apparent similarity in this respect that, in collecting, it is well to make trial of even the most unlikely spots, and, although we may meet with frequent disappointments, we shall, on the other hand, often find what we will deem prizes where they are least expected.

2. *Time for Collecting.*—The best time for collecting these organisms is in summer, as they are then met with in the greatest abundance. There can be little doubt that heat is conducive to their increase and development. In a hot-house tank, where the heat was kept up to about 65° Fahr., one species of Ostracoda (*Cypris incongruens*) was abundant. In another tank outside of the building, where the water was supplied from the same source, but to which artificial heat was not imparted, the same species was present, but comparatively few in numbers. How far an increase of temperature may contribute to their increase of numbers or improvement of condition, or how far it may be borne with impunity, does not seem to be accurately known. Dr. G. S. Brady states that he has found them in the water of mill cooling ponds at a temperature of 100° Fahr., and the water might at times be even

hotter.* At Messrs. Barr & Co.'s cooling pond, Paisley, I have found them at a temperature of 85° Fahr.; the species was *Cypridopsis vidua.* I may mention, in passing, that the species which have come under my own observation as having been subject to high temperature—viz., *Cypris lævis, Cypris incongruens,* and *Cypridopsis vidua*—were all unusually light in colour. For some time I kept a gathering of Ostracoda in a broad shallow vessel placed near my window. In the cold mornings of March not one of them was to be seen; but further on in the day, when the sun was hotter, the different species of *Cypris* came from their hiding places in the mud to swarm about actively up the sides of the vessel, more particularly on the side next the light; and the non-swimmers *(Candonæ)* came more to the surface of the mud. This I have often repeated with the same result—hence the better prospect of collecting "when the sun shines." Yet good gatherings may occasionally be made during the colder seasons of the year, and I have even had some excellent hauls in the month of January, when I had to break the ice and work underneath it. These gatherings were not only fair in numbers and variety, but contained species not found as a rule in the same tarns during the months of summer. It is by no means of rare occurrence to find a species abundant at one season and entirely absent in the same place at another. On returning to search the same lake or pool after an interval of two or three months at any period of the year, all the same species will seldom if ever be met with, or grouped in the same proportions. As one instance amongst many I may state that a gathering was taken on May 21, 1878, in the old dam which supplied the Govan Colliery. It was about 70 yards in circumference and a foot or two deep; the whole was covered with green *confervæ,* rather ropy but not slimy, and a little grass round the sides. The number of Ostracoda obtained was twelve species. This gathering presented a remarkable feature in the excessive abundance of *Cypris reptans,* far exceeding anything I had ever seen before of this species. Another gathering was taken from the same dam, November 20, 1878. There were little or no *confervæ* this time—nothing except a little grass round the sides and some thin growths out from the margins towards the middle. *Cypris reptans* was now only represented by a few examples, which were all that were seen remaining of a species so numerous on a former occasion. It was, however, plentifully replaced by *Cypris virens,* which, on the other hand, had been wholly absent in the first gathering.

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* Brady, *Monograph Rec. Brit. Ostrac.*, p. 368.

On March 9, 1879, after the severe frost, the dam was again visited. It showed little new growth of vegetation, further than some straggling blades of grass, the sides still fringed with the old autumnal weeds. There was no great variety found this time. *Cypris reptans* was wholly absent, so was *Cypris virens.* The prevailing Ostracod now was *Cypris compressa.*

Another gathering was taken on May 21, 1879, just a year after the first trial was made. On this occasion there were no *confervæ* nor *Cypris reptans,* both so abundant on the same date last year, showing that we cannot be certain of finding even the same species where they had been abundant in the same month of the previous year. This probably depends on the time of reproduction, or to some extent on the different varieties of animal and vegetable life that abound at the various seasons, and are more or less favourable in respect of food, shelter, &c., to the different species of Ostracoda.

3. *Mode of Collection.*—Unlike the marine, the fresh and brackish-water Ostracoda are within the reach of everyone, and the mode of capture is so easy that it can offer no obstacle to the pursuit. They are generally collected with a hand net; but when it is desirable to examine the ooze from the bottom of deep lakes, a boat and dredge are necessary. The size of the net usually employed has the ring of the mouth about 10 inches in diameter, and the net about 20 inches deep. Such nets are to be had ready-made, which screw from the handle and fold into 3 segments, so as to be more portable. In my own experience, I find one of much smaller size very efficient, one without the folding joints, having the ring only 6 inches in diameter, and the muslin bag not less than 24 inches deep, and rounded at the bottom. The greater the proportion the bag is to the ring the more freely the water will pass. The mesh of the net may be about 100 threads to the inch. The ring is made of ¼-inch brass wire, which is strong enough to bear the pressure amongst pond weeds, or in raking the mud from the bottom. A socket or screw projects from the ring for the reception of the handle, whether a walking-stick or other rod more or less long.

A rod from 6 to 9 feet long has a great advantage over a walking-stick, both in reaching to a greater distance and affording a greater leverage. The rod may be made to screw off in two or three lengths of 3 feet each, and can be conveniently carried in a sheath. This smaller size of net has the great advantage of admitting conveniently a brass wire sieve, with a hoop about an inch deep to fit into the ring of the muslin net, preventing weeds and other coarse material from getting into the bag, but sufficiently open to allow all the Microzoa to pass through. I find a sieve with a ¼-inch mesh very suitable. This protecting sieve requires to be fitted tight into the mouth of the muslin net, so as not to fall out when working, but sufficiently easy to be taken off when the contents of the bag are turned out. For security, it is better to have the sieve slung to the neck of the handle by a short cord. The size of net is large enough to take in abundance of water with the Microzoa, and is exceedingly well fitted to sweep and probe amongst the vegetation, or to rake up the mud from the bottom, being at the same time quite conveniently portable. The common Dutch *hoe* has been used for the frame of the net, by piercing the inner edge of the front plate with holes to sew the bag to. The remaining part of the mouth of the bag is attached to the fork and back part of the hoe, but is not so well adapted for working advantageously amongst the vegetation. To work the net, simply sweep it through the vegetation along the margin of the pond; this done, remove the sieve, invert the bag, and convey the contents into a white saucer with water or wide-mouthed bottle, which will, in most cases, indicate whether there is anything worth further trial, though it often happens that repeated trials afford good results in the same place where they had failed to be seen by the first inspection. The Ostracoda generally withdraw within their shells and become motionless when alarmed, and are difficult to be seen in this state among the *debris* of the gathering, but, where they do exist, more or less of them come to the surface, and are readily detected in an open vessel, but equally as well and more easily by examining the contents of the net when the water is well pressed out.

To have the full benefit of the gathering for Ostracoda, it is necessary to take some of the mud, which in most cases can be readily procured by scraping the sides or bottom of the pool with the ring of the net. In order to reduce the bulk as much as possible, all the impalpable mud should be washed thoroughly away till the water runs off clear. This can be done either in the working net, or in a separate bag of the same texture without the hoop. If the contents are to be examined in the dry state, they may at once, after the water has well run out, be put into a small bag and labelled. In all cases when the water has to be pressed out it is better to do so in a separate bag or cloth of stronger texture, as the thin muslin working net is apt to give way in that operation. The label is best preserved when enclosed in a small wooden needle-case and put into the bag. To provide for the examination of the soft animal tissues, the whole or a portion of the material may be put into a bottle with spirits. When it is desirable to study the habits of the living animals, the gathering may be taken home in water in an 8 or 10-ounce bottle, and transferred to a white shallow vessel, where the animals can be well seen, and their various movements observed. In this state the life-appearance of parts of the animal can be more satisfactorily made out than after they have been either dried or preserved in spirits.

It may be further remarked that the washing away of all the impalpable mud is of great importance, independently of the reduction of bulk, because, where the mud is retained, it acts in drying as a cement, and becomes hard and difficult to dissolve. When thoroughly washed, the vegetable residue requires only to be dried in order to be ready for examination, thus avoiding the operation of "floating," which never can be done successfully where there is much vegetable matter, as is generally the case in fresh-water gatherings, which comes to the surface along with the Microzoa. Therefore floating can only be done with advantage when there is much heavy material to be got rid of that will sink to the bottom, as sand or gravel.* When the material requires to be "floated," it has first to be well dried and then placed in plenty of water, and well stirred. The heavy material will then sink, and the light buoyant Microzoa come to the surface, where they can be skimmed off, and drained through a sufficiently fine sieve. The skimming and stirring may with advantage be repeated several times. The skimmings should be well washed in the sieve and dried; when the Ostracoda can easily be picked out with a hand lens and camel-hair pencil. In the dry state a series of brass or copper wire sieves will facilitate the work greatly; a set of four, fitting into each other, suits very well, the largest being 5½ or 6 inches in diameter, and an inch in depth, and the rim of each projecting a little under the bottom, so as to leave space for what passes through the different sieves. The uppermost sieve should have a mesh of 12 wires to the inch, the next 24, the next 36, and the undermost 76 to the inch, which is sufficiently fine to retain all the Ostracoda. The first or uppermost sieve retains few or no Ostracoda, but removes all the coarse material. In most cases a great deal of vegetable fibre remains in the sieves, and may be blown off, but this must be done carefully, so as not to blow away any of the smaller Ostracoda.

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* The mode of "floating" was given in a paper read before the Geological Society of Glasgow (see *Transactions*, vol. v., p. 152), but for convenience it may be repeated here.

4. *Mode of Preservation.*—Little need be said on this head, as Ostracoda require no special appliances for preservation, so far as the shell is concerned, further than allowing them to dry; but when the animals are wished to be preserved for anatomical investigation, alcohol is the usual medium, and perhaps, with the addition of a little glycerine, is the best.

A few hints, however, as to arrangements for their inspection and reference may be useful. As they are all opaque objects, they should in most cases be mounted dry on black cardboard. Slides or tablets for this purpose are generally made 3 inches long by 1 inch broad, with a round or oblong black-bottomed cell, in which the objects may be fixed with a little gum in one or more rows. It is the general custom to cover the cells with small squares or circles of thin glass, and the whole tablet with paper, with a hole punched over the cell. I prefer for the opaque shells of Ostracoda, which do not require high powers, common thin plate or crown glass, large enough to cover the whole tablet, fixed on by a slip of gummed paper carried round the edges, which keeps both objects and labels clean and secure. These glass slips may be had from any glazier, picked from his scraps, at a very moderate price. The various methods of mounting the animal tissues are so generally known that it is unnecessary to repeat them here. For exchange or presentation it is exceedingly convenient to have a series of loose duplicates in the tablet slide cells, with the glass cover simply tied on at the ends with thread.

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